

## The solitary planktonic chrysophyte *Dinobryon faculiferum*: an alga species typically restricted to brackish environments found inhabiting a freshwater loch in northern Scotland

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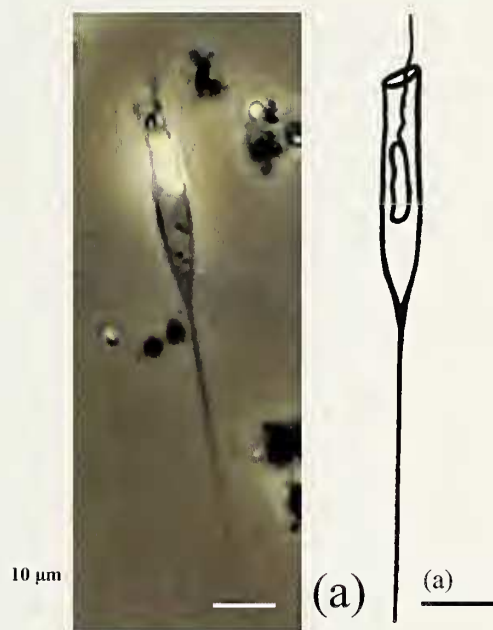
*Dinobryon faculiferum* (Willén) Willén [= *Dinobryon petiolatum* T. Willén] is a solitary planktonic chrysophyte ('golden') alga (Lang *et al.*, 2011) typically restricted to brackish environments (Willén, 1963), and hence not currently recognized in John *et al.* (2011). One of several solitary life forms in the genus, *Dinobryon faculiferum* is distinguished from similar species (e.g., *D. borgei*) by a prominently elongate spine, length usually 40 – 60 µm (Willén, 1963), although this characteristic feature can at times be quite variable (Willén, 1992) (Fig. 1a, b). Although primarily documented from sea water (e.g., Unrein *et al.*, 2010), *D. faculiferum* has also been recorded amongst the phytoplankton of a saline lake in Venezuela (Lewis & Riehl, 1982) but never previously from U.K. freshwater habitats.

In the course of analysing phytoplankton samples collected as part of the Scottish Environment Protection Agency's ongoing assessment of the ecological status of freshwater lochs in Scotland (Lang *et al.*, 2013), *Dinobryon faculiferum* was observed sporadically (e.g., 1 – 3 cells per 100 ml sub-sample) in Loch Kinord, between 2009 and 2012, and often co-occurred with a number of other *Dinobryon* species (e.g., *D. bavaricum*; *D. borgei*; *D. crenulatum*; *D. divergens*; *D. sociale*; *D. suecicum*).

Loch Kinord is a freshwater loch in northern Scotland, located approximately 50 km inland from the North Sea coastline. Its water quality characteristics have been described elsewhere (Lang *et al.*, 2012). Perhaps the water environment

provided by Loch Kinord is slightly brackish (annual mean sodium and chloride concentrations respectively 9.23 mg L<sup>-1</sup> and 18.05 mg L<sup>-1</sup> in 2012), which generally fits in with the current distribution pattern of *D. faculiferum* (Willén, 1963; Unrein *et al.*, 2010). However, this constitutes the first known record of the species from British freshwaters (D. John, *pers. comm.*).

Although widely-regarded as a marine species, we have shown that *D. faculiferum* is also capable of inhabiting freshwater environments. Whether our Scottish specimens of *D. faculiferum* are genetically similar to coastal populations derived from elsewhere in Europe remains to be determined, but identifies an area that would benefit from further research.



**Fig. 1.** *Dinobryon faculiferum*. (a) Photomicrograph of *D. faculiferum* preserved in Lugol's iodine. Scalebar, 10 µm. (b) Line drawing of *D. faculiferum*.

### ACKNOWLEDGEMENTS

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## ***Ollicola vangoorii* (Chrysophyceae, Chromulinales): an unfamiliar loricate protist newly documented in U.K. freshwaters from a southern upland loch, Scotland**

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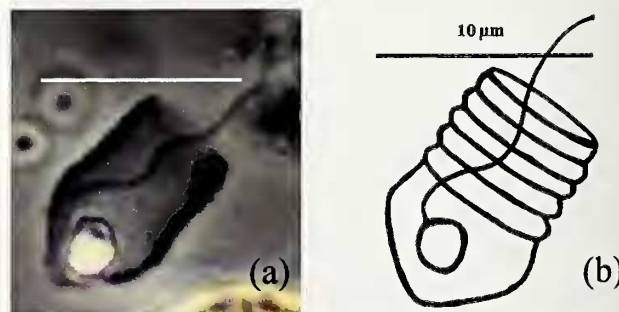
*Ollicola vangoorii* (W. Conrad) Vørs [= *Calycomonas vangoorii* (W. Conrad) J.W.G. Lund] is a flagellate protist belonging to the chrysophyte ('golden') algae (Lang *et al.*, 2011), with a coastal temperate to polar distribution (Vørs, 1992). The protective envelope of this alga is characterized by transverse striations that produce the distinctly corrugated appearance of the species' vase-like lorica (Lund,

1960; Starmach, 1985) (Fig. 1a, b). Until now, *O. vangoorii* has not previously been recorded in U.K. freshwaters (G. Novarino & D. John, *pers. comm.*).

In the course of analysing phytoplankton samples collected as part of the Scottish Environment Protection Agency's ongoing assessment of the ecological status of freshwater lochs in Scotland (Lang *et al.*, 2013), small numbers (5 – 10 cells per 100 ml) of *O. vangoorii* were found in Loch Grannoch during the summer months of 2012. Loch Grannoch is situated in a largely afforested catchment of the southern uplands of Scotland (NGR: NX 54153 69674). It is an elongated lake with a surface area of c. 1.14 km<sup>2</sup>, characterized by an acid-sensitive (annual mean -0.82 mg L<sup>-1</sup> as CaCO<sub>3</sub> in 2012) and slightly mesotrophic water chemistry [annual mean total phosphorus (TP) concentration 15.4 µg L<sup>-1</sup> in 2012].

Although *O. vangoorii* is typically known as a marine taxon (e.g., Novarino *et al.*, 2002), and is hence not currently featured in John *et al.* (2011), the species has also been documented from less saline Danish inland waters (G. Novarino, *pers. comm.*). Therefore, its occurrence in a freshwater environment is probably not unexpected, and furthermore suggests the species is adapted to a wide salinity range. This may well depend upon distinct eco-physiological variants. However, there seem to be no noticeable morphological differences in relation to salinity (G. Novarino, *pers. comm.*). Whether the *O. vangoorii* found to occur in freshwater is genetically similar to those inhabiting the marine environment, remains to be determined.

Besides the potential for a mixotrophic existence [i.e., capacity to derive energy from photosynthesis and by ingesting bacteria (Novarino *et al.*, 2002)], the ecological significance of *O. vangoorii* is poorly understood. Nonetheless, we present another interesting algal find that is completely new to the freshwaters of the British Isles.



**Fig. 1.** *Ollicola vangoorii*. (a) Photomicrograph of *O. vangoorii* preserved in Lugol's iodine. Scalebar, 10 µm. (b) Line drawing of *O. vangoorii*.

### **ACKNOWLEDGEMENTS**

Thanks especially to Dr Gianfranco Novarino and Professor David John (Natural History Museum, London) for formally verifying the identity of *O.*